Medical Xpress

Self-powered 'pacemaker for life' in pigs unveiled

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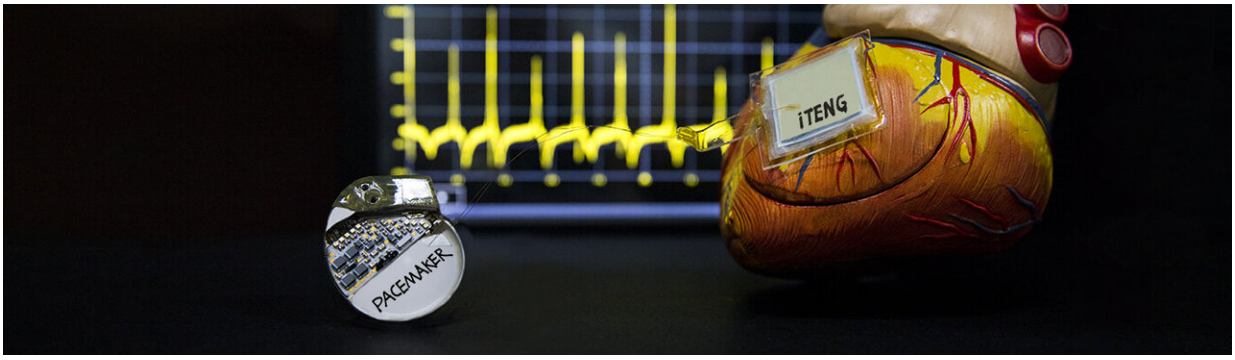

The symbiotic pacemaker based on implantable triboelectric nanogenerator. Credit: Zhou Li

Scientists on Tuesday unveiled a battery-free pacemaker that generates its energy from the heartbeats of pigs in what could pave the way for an "implant for life" in humans suffering from heart defects.

Millions of patients rely on pacemakers —small electrical implants in the chest of abdomen—to help regulate their heartbeats after chronic or acute illness.

Even with recent technological advances, pacemaker batteries can be rigid or bulky, and may need replacing several times over the lifespan of a device.

Energy harvesters, which generate electricity from pulses sent by the body, have shown to be effective in recent years, but only in small animals such as rats, as well as cell models with low energy demands.

Now researchers in China and the United States believe they have successfully trialed a self-powered pacemaker in adult pigs—an animal remarkably physiologically similar to humans.

The animals selected suffered from irregular heartbeat similar to human pacemaker patients.

The team developed an implantable generator that sits on the surface of the heart and bends with each heartbeat, thereby generating electricity from kinetic energy.

"(The pacemaker) was fully implanted in adult pigs and all of the energy for cardiac pacing is reclaimed from the heart-beating energy of the same animal," Zhou Li, from the Chinese Academy of Sciences and lead study author, told AFP.

When they powered up the devices they found that the pigs' irregular heartbeat was corrected.

Furthermore, the energy retained from every heartbeat turned out to be higher than the energy demands of most current pacemakers in humans, opening the door to someday giving patients a permanent power source for their implants.

"It could be an 'implant for life'," said Zhou. "This is our aim and the final goal of the scientific research in the field."

The team stressed however that more work was needed to determining the long-term safety and durability of the devices before human versions

could be developed.

Zhou said the self-powering technology could also have a range of applications in areas such as self-charging devices and "smart" clothing.

Tim Chico, Professor of Cardiovascular Medicine and Honorary Consultant Cardiologist, University of Sheffield, who was not involved in the research, called the experiment "very encouraging".

"This study was performed in pigs, whose hearts are the same size as humans, and so are often used to test devices or treatments before use in man," he said.

The study was published in the journal *Nature Communications*.

More information: Symbiotic cardiac pacemaker, *Nature Communications* (2019). DOI: 10.1038/s41467-019-09851-1 , www.nature.com/articles/s41467-019-09851-1